c. If The Commission Determines That Neither Its Spectrum Sharing Proposal Nor The Conduct Of A Comparative Hearing Is Viable, Then It Should Assign MSS Above 1 GHz Licenses By Lottery.

If the Commission is ultimately left with the unsatisfactory choice of assigning MSS Above 1 GHz licenses either by auction or by lottery, it should select the latter approach. The negative policy ramifications of auctioning the domestic portion of spectrum for inherently global satellite systems are significantly more severe than any difficulty that would be engendered by using lotteries to assign this spectrum. See Section 2, supra. The adoption of a random selection procedure would, of course, require a clear and careful explanation justifying the Commission's departure from its own prior practice, but this is nevertheless a feasible option. On the other hand, use of competitive bidding in this context could have long-term negative consequences for U.S. policies and interests abroad, the magnitude of which cannot even be precisely gauged. International accommodations are, by nature, very delicate, and the Commission should not risk upsetting an already precarious balance in a domestic proceeding where numerous other options are available.

In the event that lotteries are used, the Commission should, as suggested in the NPRM, "permit applicants to agree among themselves that they will implement co-frequency systems if one of them is chosen as the tentative selectee," thereby permitting the Commission to award licenses to all of the qualified applicants in such a

group.[188] It would be poor policy indeed, and counterproductive to the public interest in achieving competition among multiple service providers, for the Commission to restrict in any way the formation of such cooperative groups. Applicants that propose to share spectrum should be permitted to pool their lottery "chances" so that they can work together to secure spectrum in which to provide competing services.

The Commission also solicited comment in the NPRM concerning what options should be permitted if the spectrum blocks assigned to an applicant via lottery do not match its needs, i.e., if it receives either more frequency blocks than it needs or obtains blocks that it cannot use.[189] TRW suggests that if an applicant receives through lottery either less spectrum than it requires, or spectrum that it is unable to use, it should have the initial option of negotiating a trade of spectrum blocks with other assignees as a means of resolving the disparity.

However, if it proves infeasible to negotiate a "spectrum barter" within a reasonable length of time established by the Commission, the excess or unusable spectrum should simply be returned to the lottery pool for redistribution to the other lottery participants. For the same reasons that auction of spectrum by the Commission is inappropriate, it would be inappropriate to permit an applicant to reap a monetary

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188/ NPRM, 9 FCC Rcd at 1119 (¶ 47).

189/ See id.

windfall simply because it does not obtain the spectrum it requires to implement its MSS Above 1 GHz system, but still acquires critical frequencies that could frustrate the service objectives of other applicants. A contrary policy could permit an applicant either to warehouse a strategic spectrum block in order to stall implementation of service by a more fortunate lottery assignee, or to exact an exorbitant payment in order to relinquish the critical frequency block. Such an outcome would not be in the public interest, but would only serve to unreasonably enrich private parties.

III. INTERSERVICE SHARING

A. RADIO ASTRONOMY SERVICE

In its NPRM, the Commission embraces and proposes to codify those provisions of the Report of the MSS Above 1 GHz Negotiated Rulemaking Committee that addressed sharing between MSS Above 1 GHz systems and U.S. Radio Astronomy Service ("RAS") sites during periods of RAS operation.[190/] The Commission's proposals spell out the measures MSS Above 1 GHz systems will be required to take to protect existing facilities used by the RAS from unacceptable in-band and out-of-band interference and second harmonic spurious emissions.[191/] The Committee's conclusions as to MSS/RAS sharing were developed with TRW's active participation. As such, and but for a few relatively minor requests for clarification or amplification, the Commission's proposed regulatory treatment of MSS/RAS sharing is acceptable to and supported by TRW.

190/ See NPRM, 9 FCC Rcd at 1120-22 (¶¶ 49-52) (citing Committee Report).

191/ Because both the RAS and MSS have co-primary allocations in the 1610.6-1613.8 MHz bands, each has a right to operate in those bands equal to that of the other. Therefore, neither the RAS nor MSS Above 1 GHz systems should necessarily be required to shoulder the full burden of accommodating each other's operations. Also, RAS suffers interference from in-band operations of GLONASS, and will benefit from any solution to the MSS-GLONASS situation that removes GLONASS to frequencies well below 1610 MHz.

1. Protection of RAS Sites Should Be Permitted Via Either Fixed Radius Or Beacon-Actuated Protection Zones.

TRW generally supports the technical parameters proposed by the Commission for fixed radius protection zones to shield RAS sites against interference from MSS Above 1 GHz systems. Specifically, TRW supports the establishment of fixed radius protection zones as set forth in Proposed Rule Sections 25.213(a)(1)(i)-(v), the restrictions on out-of-band and spurious emissions in Proposed Rule 25.213(a)(3), and, with certain reservations, the restrictions in Proposed Rule 25.213(a)(2).[192/]

TRW also supports the Commission's proposal to permit MSS Above 1 GHz providers to employ beacon-actuated protection zones instead of fixed radius protection zones to guard RAS sites against unacceptable interference.[193/] In order to establish beacon-actuated protection zones, one or more omnidirectional radio beacons would be placed near RAS sites that conduct observations in the 1610.6-1613.8 MHz bands. The beacons would transmit signals only when observations were

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192/ As explained in subsection III(A)(4), infra, TRW urges the Commission to restrict out-of-band emissions of satellite space stations transmitting in the 1613.8-1626.5 MHz band in terms of dB(W/m^2/MHz) in lieu of imposing restrictions on a per-hertz basis.

193/ See NPRM, 9 FCC Rcd at 1158 (Appendix A, Proposed Rule 25.213(a)(1)(vi)). Proposed Rule 25.213(a)(1)(vi) states only that "[a] beacon-actuated protection zone may be used in lieu of fixed protection zones in the 1610.6-1613.8 MHz band if a coordination agreement is reached between a mobile-satellite system licensee and the ESMU on the specifics of beacon operations." The ESMU is the Electromagnetic Spectrum Management Unit of the National Science Foundation, Washington, D.C.

in progress. If an MSS mobile terminal received a beacon signal above a defined threshold power level, transmissions by that terminal over certain frequencies would be automatically inhibited or shifted to other channels that would not overlap with RAS observations.

While both fixed radius and beacon-actuated protection zones would provide RAS sites with adequate protection during observation periods, beacon systems would provide the additional benefit of allowing MSS Above 1 GHz terminals to operate virtually without restriction at all other times. The use of beacon systems would thereby enable MSS Above 1 GHz systems to maximize the efficiency of their use of the 1610.6-1613.8 MHz bands.

Beacon systems would also minimize restrictions on the use of MSS mobile terminals in the vicinity of RAS sites during periods of observation. While an RAS site's beacon would send signals in all directions during periods of observation, an MSS mobile terminal would only receive those signals if they were not blocked by intervening terrain or subject to propagation losses and other real-world effects. Because an MSS mobile terminal that could not receive a beacon's signal also could not interfere with the RAS observations that the beacon would protect, the MSS mobile terminal would permit the use of frequencies shared with RAS to communicate with the MSS Above 1 GHz satellite system. The use of real, rather than theoretical, radio frequency boundaries would once again permit the most efficient possible use of

the 1610.6-1613.8 MHz bands, and would maximize the utility of MSS Above 1 GHz systems to the public.

2. Position Determination Capability Should Not Be Required Of MSS Above 1 GHz Systems Using Beacon-Actuated Protection Zones.

Proposed Rule 25.213(a)(1) states: "All 1.6/2.4 GHz Mobile-Satellite Service systems shall be capable of determining the position of the user transceivers accessing the space segment through either internal radiodetermination calculations or external sources such as LORAN-C or the Global Positioning System."[194/] TRW requests clarification that this requirement will not apply to MSS Above 1 GHz systems employing beacon-actuated protection zones.

The Commission apparently proposed the position determination requirement to assure that MSS Above 1 GHz systems would be capable of protecting RAS observation sites from interference generated by user transceivers located within the fixed-radius protection zones in Proposed Rules 25.213(a)(1)(i) and (ii), and from interference caused by user transceivers on nearby aircraft as well. If RAS observation sites were equipped with beacons, however, the transmissions of any user transceiver that was in a position to cause harmful interference during observation periods would automatically be inhibited or would be shifted to another channel upon

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194/ NPRM, 9 FCC Rcd at 1157 (Appendix A, Proposed Rule 25.213(a)(1)).

receipt of the beacon signal. Position determination capability of the accuracy required for fixed-radio protection zones would therefore serve no purpose in a beacon system. Without the need for such capability, the Commission's requirement would be an unnecessary burden on MSS Above 1 GHz licensees that choose not to offer such service and would simply raise the cost of service to the public. Accordingly, TRW requests that the Commission clarify that MSS Above 1 GHz systems employing beacon systems need not be capable of determining the position of user transceivers, except insofar as is necessary for normal system operation.[195/]

3. The Grant Of Interference Protection For Additional RAS Sites Should Be Subject To Public Comment.

In Proposed Rule 25.213(a)(1)(vii), the Commission suggests that additional RAS observation sites[196/] may be granted protection similar to that which would be granted to the sites listed in proposed subsections (i) and (ii), "one year after notice to the mobile-satellite system licensee and the issuance of a public

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195/ TRW suggests that the clarification requested here could be accomplished simply -- i.e., by redesignating Proposed Rule 25.213(a)(1)(vi) as proposed Rule 25.213(a)(2), and by redesignating Proposed Rules 25.213(a)(2) and (a)(3) as 25.213(a)(3) and (a)(4), respectively.

196/ The additional sites covered by the proposed rule would be any sites not located within 100 miles of the 100 most populous urbanized areas as defined by the U.S. Census Bureau at the time. See NPRM, 9 FCC Rcd at 1159 (Appendix A, Proposed Rule 25.213(a)(1)(vii)).

notice by the Commission."[197/] The Commission's proposed rule does not specify that public comment will be entertained before such additional restrictions on MSS Above 1 GHz services are imposed.

As TRW has already observed, MSS Above 1 GHz service has co-primary status to operate in the bands in which RAS sites conduct their observations, and therefore has rights equal to those of the RAS community to make use of those bands.[198/] Although it is reasonable to expect that the RAS community may seek to establish new sites in the United States at some future point, it should not be permitted to do so unilaterally and still command interference protection from MSS Above 1 GHz systems for such sites any more than MSS Above 1 GHz systems should be entitled unilaterally to eliminate one or more of the fixed protection zones that the Commission has proposed. Rather, both services must recognize each other's rights and negotiate solutions to their differences as parties of equal stature under the Commission's auspices.

TRW asks the Commission to recognize that, just as the observations of the RAS community are of great scientific importance and social value, there is public interest and social value in the establishment of viable, global satellite systems for the

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197/ Id.

198/ See 47 C.F.R. § 2.105(c)(2) (1992) ("Permitted and primary services have equal rights, except that, in the preparation of frequency plans, the primary services, as compared with the permitted services, shall have prior choice of frequencies.")

exchange of vital information. The Commission should not deprive members of the public of the benefits of such systems until it has had an opportunity to make a reasoned decision based on the merits of all interested parties' positions.

4. To The Extent That RAS Operations At 1610.6-1613.8 MHz May Require Protection From MSS Uplink Operations In The 1613.8-1626.5 MHz Bands, Any Limits On Out-of-Band Emissions Should Be Expressed In MHz, Not Hz.

In its NPRM, the Commission notes the recommendations of the MSS Above 1 GHz Negotiated Rulemaking Committee regarding the protection of RAS operations at 1610.6-1613.8 MHz against harmful out-of-band interference from MSS uplink and downlink operations in the 1613.8-1626.5 MHz portion of the band.[199/] The Commission states that the Committee's recommendations on this matter "are set forth in proposed rule section 25.213(a)(2)."[200/]

Proposed Rule 25.213(a)(2) establishes out-of-band limits for MSS Above 1 GHz space stations that may operate in the 1613.8-1626.5 MHz band, but does not address MSS Above 1 GHz uplinks. TRW has no comment on the downlink emission limits. To the extent, however, that the Commission may ultimately decide

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199/ NPRM, 9 FCC Rcd at 1121 (¶ 51).

200/ NPRM, 9 FCC Rcd at 1122 (¶ 51).

to adopt out-of-band emission limits for MSS uplink operations,[201/] TRW urges the Commission to express such limits in terms of dB(W/m²/MHz), as opposed to an emission limit based on a per-hertz figure.

For MSS Above 1 GHz systems that use CDMA channels with bandwidths in excess of one megahertz, the out-of-band spectral roll-off across the adjacent one megahertz band will be significant. The use of an out-of-band emission limit defined in terms of a one megahertz reference bandwidth would permit consideration of the average power, a measurement which is likely to be of much greater use to the RAS community than a worst-case, per-hertz value. Thus, if the Commission were to decide that an out-of-band emission limit would be appropriate for MSS uplink operations at 1613.8-1626.5 MHz, and recognizing the Committee's efforts in this area, TRW would favor a requirement that mobile-satellite service mobile earth stations transmitting in the 1613.8-1626.5 MHz band limit out-of-band emissions so as not to exceed - 178 dB(W/m²/1MHz) during observations at the facilities listed in Proposed Rule 25.213(a)(1)(i) and - 138 dB(W/m²/1MHz) during observations at the facilities listed in Proposed Rule 25.213(a)(1)(ii).

201/ The Commission appears to have recommended such a limit. See Committee Report at 41 (§ 5.2.2.2).

B. AERONAUTICAL RADIONAVIGATION SERVICE AND RADIONAVIGATION SATELLITE SERVICE

Concerns over the sharing of spectrum between the aeronautical radionavigation services and MSS were among the most troublesome matters to arise during the negotiated rulemaking in this proceeding. At WARC-92, consideration was given to the protection of the only planned aeronautical radionavigation service ("ARNS") system that shared spectrum with the primary MSS above 1610 MHz -- the Russian GLONASS system. Protection for this service was provided for in Footnote 731F (then 731X), which was added during WARC-92. This footnote prescribed uplink EIRP density limits based on calculations of the potential interference from terrestrial mobile terminal transmissions into in-flight aircraft GLONASS receivers. The proposed MSS Above 1 GHz systems that make use of CDMA access techniques were able to comply with these defined limits across the full available bandwidth.

During the negotiated rulemaking, however, the aviation community presented a new scenario for the use of GLONASS, which involved reliance on the Russian aeronautical radionavigation system during all phases of commercial aircraft flights, including taxiing on airport runways (the "gate-to-gate" scenario). The use of GLONASS for these purposes inevitably leads to an increased number of situations where the MSS mobile terminal may be located in close proximity to an aircraft. This, in turn, imposes such severe emission constraints on the MSS mobile terminal

that it is no longer possible for the primary MSS allocation to be utilized in frequencies used by the GLONASS system. Indeed, the interference analysis presented by the aviation community to the negotiated rulemaking committee would require considerable guardbands between GLONASS and MSS operations to account for the out-of-band emission roll-off of the MSS mobile terminal. With these assumptions, MSS would be limited to frequencies well above 1616 MHz.

The logical conclusion of this approach to frequency sharing between ARNS and MSS relegates MSS to no better than a secondary service, which was never the intention of WARC-92. Indeed, the development of new ARNS service applications, which might extend the ARNS operating spectrum to even higher frequencies, could render MSS operations in this band completely impossible. Future evolution of the ARNS along these lines might ultimately result in the need to suspend MSS operations once expensive MSS systems have been deployed. Such a prospect would clearly prevent MSS development from taking place in these bands.

Thus, it is encouraging that the Commission recognizes the absurdity of the aviation community's claim for protection of GLONASS to these extremes.[202/] There is clearly a strong argument in this instance for equitable burden sharing to solve the potential interference problem. In view of the fact that the aviation community has decided to use an ARNS system in a way that makes it significantly

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202/ See NPRM, 9 FCC Rcd at 1123 (¶ 56).

more sensitive to interference, it is appropriate for the aviation community itself to adopt measures to ameliorate or avoid such interference.

Fortunately there appears to be a viable solution that produces this result -- removing the GLONASS operations to frequencies sufficiently below the MSS band to avoid the interference. The feasibility of this has been demonstrated recently by the operators of the GLONASS system through suppressing use of some GLONASS frequencies within the RAS bands. A series of bi-lateral discussions among the Russian Federation, the United States, Australia and Japan have indicated that the Russian Federation may be able to suppress additional frequencies and/or move the GLONASS operations to frequencies below the MSS band.[203/] However, there remains considerable uncertainty as to whether these measures will actually be implemented and when this might occur. Although it would clearly be desirable for this issue to be resolved prior to the conclusion of this proceeding, such an outcome is exceedingly unlikely.

It is therefore of paramount importance that the final rules for the MSS Above 1 GHz service take full account of the uncertainty of the resolution of the

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203/ In order to minimize the complexity of the Odyssey mobile terminals to be used with Odyssey, and hence the cost to the end users, the out-of-band emission constraints should be as benign as possible. This can be achieved by ensuring that GLONASS is moved well below 1610 MHz, so that there is an effective guardband between GLONASS and MSS operating spectrum.

GLONASS issue.[204/] A sharing plan must be defined that can be implemented even in the worst-case scenario -- i.e., that GLONASS operates in all of the frequencies currently proposed for its use. The spectrum sharing plan should also be capable of evolving to match varying scenarios of GLONASS spectrum utilization, up to the point where the GLONASS constraints have effectively been eliminated.

Meanwhile, TRW urges the Commission, and the Departments of State and Commerce, to work diligently and at the highest possible levels within the Russian Federation and the aviation community in order to bring about a resolution of the GLONASS issue as early as possible. TRW is committed to support the U.S. Government in these endeavors since the limited portion of the L-band which is available at this time is plainly insufficient to meet the needs of the applicants or the public.

Assuming that the in-band GLONASS issue can ultimately be resolved, it is also important to minimize the potentially expensive constraints that might be imposed upon MSS mobile terminal out-of-band emissions, with the objective of protecting both GPS and GLONASS. The economic success of MSS Above 1 GHz systems is heavily dependent on the use of low cost mobile terminals. These terminal costs can be significantly increased if overly-stringent constraints on out-of-band

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204/ See Section II.(A), supra.

emissions are applied, e.g., due to unnecessarily extreme assumptions about the interference susceptibility of the GPS and GLONASS systems.

TRW therefore strongly encourages the current measurement programs and system vulnerability analyses that are underway to determine the actual protection requirements of these systems, and proposes that the Commission ultimately include protection values in the rules which result from any objective assessments. In the interim, TRW believes that resolution of this issue would be expedited if the applicants were accorded greater access to the results of the current testing programs, and it urges the Commission to utilize its good offices to secure such access from the Defense Department's Electromagnetic Compatibility Analysis Center.

C. TERRESTRIAL FIXED SERVICES IN THE 2483.5-2500 MHz BAND

Protection of the terrestrial Fixed Service from interference from MSS downlinks in the 2483.5-2500 MHz band was provided for in the WARC-92 MSS allocation by means of a threshold downlink power flux density ("PFD") level (the "trigger" level), above which MSS systems must coordinate with the Fixed Service.[205/] The trigger value used was based upon the historical precedent of C-band geostationary downlink interference into the Fixed Service, and therefore did

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205/ See WARC-92 Final Acts, Radio Reg. 2566.

not accurately reflect the new MSS allocation, in terms of the much lower frequencies and the use of non-geostationary orbits.

The ITU Radiocommunication Bureau is currently undertaking studies aimed at establishing a more appropriate trigger PFD level, based upon consideration of the actual operating parameters of MSS systems. The results of this work so far indicate that the interference caused by a constellation of non-geostationary MSS satellites varies considerably, depending upon the particular MSS system design. In other words, a single PFD mask is not appropriate to all MSS system designs.

In this respect Odyssey is unique because of its high satellite elevation angles. This extra degree of angular separation between Odyssey satellites and fixed service receivers, which no other proposed MSS Above 1 GHz system has, allows Odyssey to avoid the interference susceptibility to the Fixed Service. Odyssey can therefore operate at higher maximum PFD levels without causing harmful interference into the Fixed Service. This feature of Odyssey, along with its beam steering capability, provides more efficient sharing of the spectrum between the Fixed Service and MSS than with any other proposed MSS system.

In order to exploit the attributes of Odyssey to the maximum extent possible, and to allow the Commission to establish rules in the near term before the ITU Radiocommunication Bureau studies are completed, TRW proposes the following course of action:

(1) retain the PFD trigger values as currently contained in the Radio Regulations and use them as trigger values for coordination purposes;

(2) establish an intermediate coordination stage which involves a showing to the FCC by the MSS system operators, using agreed upon computational methodologies, to demonstrate that unacceptable interference is not caused to the Fixed Service, even though the PFD trigger level may be exceeded by at least 6 dB in some cases;[206] and

(3) in the event that such a showing is not conclusive, institute a series of conventional bilateral coordinations between the MSS system and Fixed Service system operators.

Indeed this proposed approach is the same as that currently being drafted within the US Radiocommunication Bureau study group, which will be proposed for adoption by the ITU on a worldwide basis.[207]

D. INSTRUCTIONAL TELEVISION FIXED SERVICE ABOVE 2.5 GHz

The negotiated rulemaking committee recognized the concern that the Instructional Television Fixed Service (ITFS) could potentially cause unacceptable

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[206] This new procedural step will obviate the need for many separate coordinations between the MSS system operator and the many Fixed Service operators, and yet will still ensure protection of the Fixed Service according to the already established interference criteria for that service.

[207] Task Group 2-2 is the study group dealing with the MSS-Fixed Service spectrum sharing issues.

interference into the primary MSS downlink allocation from the adjacent bands. Section 74.936 of the Commission's Rules is very clear as to the course of action required to resolve this interference issue. The onus is on the ITFS operator to provide the required interference protection to adjacent band services.[208/]

Considering the relatively small number of ITFS transmitters, and the ongoing transition from analog to digital ITFS systems, it would appear to be a very appropriate time to impose the required out-of-band emission constraints on the operators of ITFS transmitters. One approach, which would minimize the financial burden of any modification required, would be to apply the new out-of-band emission constraint to all new ITFS stations immediately, and to allow the ITFS operator a period of several years in which to bring existing ITFS transmitters into line with the new out-of-band requirements.

E. INDUSTRIAL, SCIENTIFIC AND MEDICAL ("ISM") EMISSIONS

As part of an on-going program established by TRW to understand better interference issues in the MSS/RDSS bands, TRW is presently conducting measurements to determine the extent of interference from industrial, scientific, and medical ("ISM") devices into MSS downlinks in the 2483.5-2500 MHz band. Based on early results, TRW is confident of a favorable outcome and will endeavor to

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208/ See 47 C.F.R. § 74.936(b) (1992).

submit its complete findings in reply comments.[209/] Depending on the final results of these measurements, and those either being performed or planned by other parties, it would also seem appropriate for the Commission to reassess the permissible levels of unwanted emissions from ISM devices, in order to maximize the possibilities of spectrum sharing between ISM and other services. Considering the scarcity of available spectrum in the 1 to 3 GHz frequency range for communications purposes, it would be irresponsible to allow poor design or poor quality control of ISM devices to seriously inhibit the use of the spectrum by other co-primary services.

This reassessment should take the form of a new rulemaking proceeding to explore the true nature of ISM interference into MSS downlinks. Proceedings along these lines should include rigorous empirical studies of actual emission characteristics and interference propagation. In such proceedings, the Commission should investigate whether higher manufacturing standards, improved equipment

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209/ Preliminary evaluation of recent tests performed as a part of the TRW research and development program has indicated that microwave ovens and ISM devices will not produce serious interference to Odyssey communications. The experimental program included a realistic transmission simulation using the allocated frequency bands at 2.4 GHz with an omnidirectional handset antenna, CDMA access, and representative link margins. This assembly was designed to measure Bit Error Rate ("BER") on the digital data stream. Tests were performed from 9 a.m. until 10 p.m.

It was observed that the BER was not degraded in most situations. Transmission was unaffected when the link was transported through the city streets and the extensive freeway system of Los Angeles. Furthermore, no degradation was observed in a wide variety of environments throughout the Greater Los Angeles area. The only conditions where any interference was observed was in urban skyscraper canyons on Wilshire Boulevard and downtown Los Angeles. Tests are continuing to expand the range of conditions and to understand the impact of the urban canyon anomaly.

design requirements, appropriate user instructions, or other means of reducing unwarranted spurious emissions might not go a long way towards ameliorating ISM interference in this band. In no event, however, should the Commission delay or unduly condition the use of the 2483.5-2500 MHz band for MSS Above 1 GHz service downlinks during pendency of any other proceedings.

F. SECONDARY DOWNLINKS

The NPRM does not make reference to the interference from secondary MSS downlink transmissions into primary MSS uplink transmissions. TRW believes that this is a serious omission, and one that the world MSS community will focus on in interpreting the U.S. position on this matter. Extensive work was performed, both during the negotiated rulemaking and in the U.S. preparatory group for the ITU Radiocommunication Bureau Study Group 8D, which demonstrated that, even when regional band segmentation is employed, there is still the possibility of harmful interference occurring into primary MSS systems operating in adjacent parts of the world. The primary interference mechanism here is the trans-horizon interference path. This interference mechanism is one of the most troublesome for several reasons.

This interference effect involves the main beam (or near main beam) of both interfering and interfered-with satellites, because all of the proposed MSS

systems need to transmit and receive signals directed to points near the earth's horizon. This is particularly true of the Iridium system which is the only proposed system that intends to use the secondary downlink allocation, and other non-geostationary systems operating with orbit altitudes below 1,500 km. Because of this there is very little antenna isolation between the two satellites, and so the interference is severe. Calculations performed during the negotiated rulemaking phase of this proceeding and more recently in the U.S. and international Study Group 8D have shown that this can result in significant reduction in the circuit capacity of the interfered-with satellites, when those satellites are operating with CDMA transmission schemes. Such a loss of circuit capacity constitutes harmful interference. In the case of interfered-with systems that are operating with FDMA or TDMA transmission schemes, the interference will result in destructive interference within the affected channels which make those channels unusable.

Band segmentation within a coverage region will not solve this interference problem, unless the band segmentation is extended to adjacent coverage regions also. In practice this could mean that frequencies in use by a secondary downlink system, such as Iridium, will not only be unavailable for use by other MSS systems which have common coverage areas with Iridium, but also unavailable to MSS systems that are operating with coverage areas that are "over the horizon" from the Iridium coverage area. Wherever Iridium is operating near an international

boundary, this will create a potential problem with respect to the neighboring countries.

The U.S. government deemed it inappropriate to air these problems in front of the international community at the international Study Group 8D meetings, although it should be noted that other administrations presented documents on this subject at the international meeting which demonstrated their concern regarding this matter. TRW reasserts the belief that it is short-sighted to ignore this problem, and the Commission should be aware of the potential regulatory and coordination problems which lie ahead as a result of ignoring it.

At the very minimum the FCC should include a section in the proposed rules which acknowledges the proposed use of the secondary downlink and the potential interference from these secondary MSS downlinks to primary MSS uplinks, and makes it clear what action should be taken by the secondary system in the event that interference occurs. This would at least allay the fears of other Administrations that the U.S. is attempting to give a system operating with a secondary allocation any higher status that is warranted.

IV. FEEDER LINKS

A. TRW AGREES WITH THE COMMISSION'S DETERMINATION THAT MSS ABOVE 1 GHZ SYSTEM FEEDER LINKS CAN SHARE SPECTRUM WITH GEOSTATIONARY FSS SYSTEMS.

Several issues are raised in the NPRM about the satellite-to-gateway and gateway-to-satellite links that will be required for the MSS Above 1 GHz systems.[210/] The first of these issues involves the ability of non-geostationary (or "LEO") systems to share Fixed-Satellite Service ("FSS") bands that they would use for feeder link operations with geostationary (or "GSO") FSS systems.

In its study of the prospects of sharing between non-geostationary and geostationary satellite systems in the same frequency bands, the MSS Above 1 GHz Negotiated Rulemaking Committee (through Informal Working Group 3) examined such subjects as the prospects for beam coupling between GSO system earth station antennas and LEO satellite antennas, and the impact, if any, on U.S. MSS Above 1 GHz systems from International Radio Regulation 2613.[211/] The Committee

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210/ See NPRM, 9 FCC Rcd at 1129-1132 (¶¶ 70-77).

211/ Radio Regulation 2613 provides, in pertinent part, that:

> Non-geostationary space stations shall cease or reduce to a negligible level their emissions, and their associated earth stations shall not transmit to them, whenever there is insufficient angular separation between non-geostationary satellites and geostationary satellites resulting in unacceptable interference to

(continued...)

reached unanimous conclusions on these matters,[212/] determining that sharing among non-geostationary system feeder links and geostationary FSS systems is feasible with coordination and that Radio Regulation 2613 does not relegate non-geostationary feeder links to secondary status in frequency bands shared with geostationary FSS systems.

1. The Commission Should Not Take Actions In Other Proceedings That May Jeopardize The Ability Of Non-Geostationary Systems To Share FSS Frequencies With Geostationary Systems.

TRW was an active participant in the development of the positions of Working Group 3 and the Committee on both the LEO/GSO sharing issue and the interpretation of Radio Regulation 2613, and notes with favor the fact that the Commission has accepted most of the Committee's conclusions.[213/] It specifically agrees with the Commission's proposal to require domestic geostationary and non-geostationary systems to coordinate use of the FSS bands on a co-equal basis, and to

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211/(...continued)

> geostationary satellite space systems in the fixed-satellite service operating in accordance with these Regulations.

WARC-92 Final Acts, Radio Reg. 2613.

212/ See Committee Report at 28-30. See also Committee Report, Annex 3 (Report of Working Group 3 to the MSS Above 1 GHz Negotiated Rulemaking Committee) at 3-11.

213/ See NPRM, 9 FCC Rcd at 1130 (¶ 74).